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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/782,928
Filing Date: February 23, 2004
Appellant(s): UEHARA ET AL.

David P. Emery
Reg. No. 55,154
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed July 14, 2009 appealing from the Office action mailed February 19, 2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

For entries (6) and (7), the patent number for Momochi reference should be (US 5,528,420).

WITHDRAWN REJECTIONS

The following grounds of rejection are not presented for review on appeal because they have been withdrawn by the examiner. The rejections of claims 25-31 under 35 USC 112, first paragraph and the rejections of claims 25-31 under 35 USC 112, second paragraph.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

4,987,487	ICHINOSE	1-1991
5,315,377	ISONO ET AL	5-1994
5,852,512	CHIKAZAWA	12-1998
5,528,420	MOMOCHI	6-1996

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1, 3, 11-13, 14, 25, 27 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Ichinose et al (PN. 4,987,487).

Ichinose et al teaches a stereoscopic or *three-dimensional image display device* that is comprised of a *display panel* (51, Figures 8-9 or 100 Figures 10-11) wherein a plurality of pixels sections including pixels displaying an image for right eyes and pixels displaying an image for left eye arranged in matrix form and *periodically* arranged in horizontal direction, (51-a1, 51-b1 etc. in Figures 8-9 or LLRR in Figures 10-11). The image display device further comprises *a lenticular lens*, serves as the *optical unit* that directs light emitted from the pixels displaying said image. It is implicitly true that a three-

dimensional or stereoscopic visible region is *inherently* defined by placing the midpoint between a viewer's right and left eyes in the visible range such that the image light emitted from the pixels for displaying the right image will incident and then be viewed by the right eye of the observer and the image light emitted from the pixels for display the left image will incident and then be viewed by the left eye of the observer, (please see Figure 9 illustrates the visible range for the three-dimensional viewing). **Ichinose** et al teaches that the normal distance between the midpoint of the *eyes* to the *lenticular lens* or the optical unit is D and the distance between the *display panel* and the optical unit is f' (i.e. the focal length of the lenticular length). The actual distance between the midpoint of the eyes and the display panel therefore equals D"= D+ f'. It is also implicitly true that there is a **most** distant point with distance D' between the midpoint of the eyes and the display panel within the three-dimensional visible region for allowing the stereoscopic image to be viewable by the observer.

As demonstrated by Figure 8, the *smallest* separation between two adjacent image pixel sections that can be *resolved* by the eyes so that one image from the first pixel section to be directed to left eye and the other image from the adjacent second pixel section to the right eye is indicated in **Figure 8** as *L*. **And the definition of the pixel section is defined as 1/L.** From simple geometry one can calculate the definition of the pixel section as the following:

Assuming the *angular separation* between the image lights from the two adjacent pixel sections is an angle *a* and the angular separation of the image light after passing through the optical unit or lenticular lens is an angle *b*. Then the following condition can be established:

L/f'= tan (*a*) and e/D= tan (*b*). "e" being the separation distance between two eyes and D is the observation distance, (between the lenticular lens and the midpoint of the eyes, please see the Figure 8 of Ichinose et al for the demonstration of "L", "f'", "D" and "e").

The **actual** distance between the midpoint of the two eyes and the display panel is D", and the distance between the **most** distant point in the three dimensional visible range and the display panel is D', and they are related as follows:

D"= D + f ' and D'> D".

One can then get the following conditions:

L+ e = (f' * tan (*a*)) + (D * tan (*b*)), for paraxial light, angle *b*= angle *a*. This means tan (*a*) equals tan (*b*). (If the optical unit is a *parallax barrier* with slits instead of the lenticular lens, the angle *a* will be equal to angle *b*, neglecting the refractivity of the lenticular lens.)

This means the following:

(L+ e) approximately equals (f' +D)* tan (*a*), which then equals to D"* tan (*a*). This means

L < D" **tan (*a*)< D'** tan(a), or 1/*L*> 1/(D"* tan (*a*))> 1/(D'*tan(a)), with the conversion factor between millimeter to inch (i.e. 25.4 millimeter per inch), **1/*L* > 25.4/(D"* tan (*a*)) (dpi).** Similarly ***L*** < D'* tan (*a*), (i.e. distance measured from display panel to the **most** distant point in the visible range), and **1/L>25.4/(D'*tan(a))(dpi).**

This means **1/*L*> 25.4/(DIS* tan (*a*)) (dpi).** By setting the distance in the normal direction of the observer to the display panel to be **DIS, wherein DIS is between D' and D" or is the most distance D'** . The **definition** of the pixel section (1/*L*) therefore is defined with respect to the angular separation of the image light from the adjacent pixel section. This reference however does not teach explicitly to have the definition to satisfy the cited equation "X>25.4/(D*tan(1'))" . The claims however also do not teach the meaning of "tan(1')", it can only be examined in the broadest interpretation. It is known in the art that **normal** or **general eyesight for human being** is 1.0, which means the *minimum* angular separation, is 1/60 degree or one minute. This leads to if the angular separation "a" assumes the value 1/60 degree or one minute, it give the minimum value for the definition. This means the **definition** is **1/*L* >= 25.4/(D'* tan (1'))(dpi).**

Claims 1 and 14 recite the phrase that "*a number of pixels sections per inch in the horizontal direction is configured such that a resolution of the image in the horizontal direction as projected in the three-dimensional visible range is no less than the resolution by the eyesight of a viewer whose midpoint between the right eye and the left eye is positioned in the three-dimensional visible rang".* This feature is **implicitly** met since the three-dimensional image is observed by the observer when the observer placing his eyes within the three-dimensional visible range, (i.e. the left eye image and right eye image are resolved and projected to the left eye and right eye respectively). The pixel definition (i.e. pixel per inch), has to be *greater* than minimum resolution of the eyesight in order for the image to be able to be viewed. Furthermore, as explicitly stated about the definition of the display has expression **1/L > =25.4/(D'* tan (1')(dpi).** This means the number of the pixels per inch is no less than the resolution of the normal eyesight.

With regard to claim 3, Ichinose et al teaches that the display device having this display panel could be a liquid crystal display device, (please see column 2, line 5 or column 5, lines 38-40).

With regard to claim 11, Ichinose et al teaches the image display device is intended for displaying three-dimensional images taken from photographs and being processed by a computer, (please see 3). However it does not specify that it is movie picture. But the application of such display apparatus to display movie pictures would have been obvious to one skilled in the art since it involves only feed in movie pictures to the computer for processing, and such modification has the advantage of displaying three dimensional movie pictures.

With regard to claims 12-13, this reference also does not teach explicitly that the display apparatus is applied to different portable devices. However since Ichinose et al does teach that the display device includes liquid crystal display and it is known in the art that liquid crystal display device is widely applied in many portable visual devices, such modifications would have been obvious to one skilled in the art to allow this stereoscopic image display device be applied in different *portable* device for providing

portable 3D views. It also has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex parte Madham, 2 USPQ2d 1647 (1987).

With regard to claim 30, Ichinose et al teaches these equations or relationships explicitly. As illustrated in Figures 9 and 10, the *angular separation* between the image lights from the two adjacent pixel sections is α and the angular separation of the image light after passing through the optical unit or lenticular lens is β. Then the following condition can be established, based on geometric and trigonometric theorem:

$L/f' = L/H = \tan(\alpha)$, this means $L = H * \tan(\alpha)$,

e/D (D is the same as D-H in the claim) $= \tan(\beta)$, this means $(D-H) * \tan(\beta) = e$,

and $n*\sin(\alpha) = \sin(\beta)$.

"2L" being the pitch of a pixel section, "e" being the separation distance between two eyes, f' being the distance between the lenticular and the pixel section (i.e. same as H, i.e. f'=H), and D is the distance between the lenticular lens and the eyes, (i.e. same as D-H, in the claim). It is noted that the lenticular lens can be attached next to the pixel section as shown in Figure 10, such that the Snell's law satisfies, $n*\sin(\alpha) = \sin(\beta)$, with n being refractive index of the lenticular lens.

2. **Claims 2, 4, and 15, 26, 28 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ichinose et al as applied to claims 1 and 14 above, and further in view of the patent issued to Isono et al (PN. 5,315,377).**

The method and apparatus for outputting image for stereoscopic vision taught by **Ichinose et al** as described for claims 1, and 14 above has met all the limitations of the claims.

With regard to claims 2 and 15, this reference does not teach explicitly about the definition of the pixel section in vertical direction of the pixels matrix. With regard to claim 4, this reference also does not teach explicitly that the optical unit can be parallax barriers with a plurality of slits. **Isono** et al in the same field of endeavor teaches a three-dimensional image display wherein a *parallax barrier* having a plurality of slits (Figures 2, 4 and 8A), that is aligned with the matrix arrangement of the pixels (Figures 8B and 9) is used to provide the three-dimensional image display. It is implicitly true for square or rectangular type of pixel section, the **same definition analysis disclosed above** also applies for the **vertical** direction of the matrix to allow the image being resolved by the eyes of the observer to achieve stereoscopic viewing. It would then have been obvious to one skilled in the art to apply the teachings of **Isono** et al to modify the display apparatus of **Ichinose** et al to use parallax barrier, an electronic one as disclosed by Isono et al, as alternative means to achieve the stereoscopic image display for the benefit of allowing different design and control, (the electronic driven parallax barrier has the advantage of controlling the slit size), that suited for different application to achieve the stereoscopic image viewing.

Claim 2 recites phrase that "*a number of pixels sections per inch in the horizontal direction is configured such that a resolution of the image in the horizontal direction as projected in the three-dimensional visible range is no less than the resolution by the eyesight of a viewer whose midpoint between the right eye and the left eye is positioned in the three-dimensional visible rang".* This feature is **implicitly** met since the three-dimensional image is observed by the observer when the observer placing his eyes within the three-dimensional visible range, (i.e. the left eye image and right eye image are resolved and projected to the left eye and right eye respectively). The pixel definition (i.e. pixel per inch), has to be greater than resolution of the eyesight in order for the image to be able to be viewed. Furthermore, as explicitly stated about the definition of the display has the expression **1/*L* > =25.4/(D'* tan (1')**)(dpi).** This means the number of the pixels per inch is no less than the resolution of the eyesight.

With regard to claim 31, Ichinose et al teaches these equations or relationships explicitly. As illustrated in Figures 9 and 10, the *angular separation* between the image lights from the two adjacent pixel sections is α and the angular separation of the image light after passing through the optical unit or lenticular lens is β. Then the following condition can be established:

$L/f' = L/H = \tan(\alpha)$, this means $L = H * \tan(\alpha)$,

e/D (D is the same as D-H in the claim) = $\tan(\beta)$, this means $(D-H) * \tan(\beta) = e$,

and $n * \sin(\alpha) = \sin(\beta)$.

"2L" being the pitch of a pixel section, "e" being the separation distance between two eyes, f' being the distance between the lenticular and the pixel section (i.e. same as H, i.e. f'=H), and D is the distance between the lenticular lens and the eyes, (i.e. same as D-H, in the claim). It is noted that the lenticular lens can be attached next to the pixel section as shown in Figure 10, such that the Snell's law satisfies, $n*\sin(\alpha) = \sin(\beta)$, with n being refractive index of the lenticular lens.

3. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ichinose et al as applied to claim 1 above, and further in view of the patent issued to Chikazawa (PN. 5,852,512).

The method and apparatus for outputting image for stereoscopic vision taught by **Ichinose et al** as described for claim 1, above have met all the limitations of the claims. Ichinose et al teaches the optical unit is a *lenticular* lens having a plurality of cylindrical lenses. However it does not teach explicitly that the cylindrical lenses are arranged periodically in the horizontal direction and extended in the vertical direction. But it is true that the lenticular lenses of Ichinose et al are arranged periodically in the horizontal direction. And it is implicitly true that the lenticular lens is extended in a perpendicular direction with respect to the periodical direction as explicitly demonstrated by the teachings of **Chikazawa**. **Chikazawa** in the same field of endeavor teaches a lenticular lens having a plurality of cylindrical lenses that are arranged along the horizontal direction of the pixels and extended in the vertical

direction. It would have been obvious to one skilled in the art to make the lenticular lens has this geometric arrangement for the benefit of providing horizontal parallax to allow stereoscopic vision.

4. Claims 1, 3, 11-14, 16, 25, 27, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Momochi (PN. 5,528,420) in view the patent issued to Ichinose et al (PN. 4,987,487).

Momochi teaches a *method* and *apparatus* for outputting image for stereoscopic vision wherein the apparatus comprises a display panel having a *plurality of pixels* forming pixel sections wherein the plurality of pixels displaying image for the right eye and image for the left eye respectively, and the pixels has a *matrix* form, (please see Figures **4** and 5) and are arranged *periodically* in horizontal direction. The apparatus further comprises an *optical unit*, such as a *lenticular lens*, for re-emitting image light from the display panel to *right eye and left eye of an observer*, respectively, (please see Figures 6-8). It is implicitly true that a three-dimensional or stereoscopic visible region is inherently defined by placing the midpoint between a viewer's right and left eyes in the visible range such that the image light emitted from the pixels for displaying the right image will incident and then be viewed by the right eye of the observer and the image light emitted from the pixels for display the left image will incident and then be viewed by the left eye of the observer. And it is implicitly true that there is a definite distance (D'), in the *normal direction* with respect to the display panel, between the *most* distant point in the three-dimensional visible range and the display panel and there is a definite distance (D"), in the normal direction with respect to the display panel, between the *midpoint* of the two eyes of the observer and the display panel.

As demonstrated by the Figure 7, the distance D", measured from the midpoint of the two eyes to the display panel, should equal to D (observation distance) *plus* (n*f). The symbol "n" means refractive index of the lenticular lens and "f" means the focal length of the lens. The *smallest* separation between two adjacent image pixel sections that can be *resolved* by the eyes so that one image from the first pixel

section to be directed to left eye and the other image from the adjacent second pixel section to the right eye is indicated in Figure 7 as Δ. And the definition of the pixel section is defined as 1/Δ. From simple geometry one can calculate the definition of the pixel section as the following:

Assuming the *angular separation* between the image lights from the two adjacent pixel sections is angle *a* and the angular separation of the image light after passing through the optical unit or lenticular lens is angle *b*. Then the following condition can be established:

Δ/n*f = tan (*a*) and W/D= tan (*b*). W being the separation distance between two eyes and D is the observation distance, (i.e. the distance between the midpoint of the eyes and the lenticular lens).

The actual distance between the midpoint of the two eyes and the *display* panel (D") and the actual distance between the **most** distant point in the three dimensional visible range and the display panel (D') have relative relationships defined as follows:

D"= D + n*f and D'> D".

One can then get the following conditions:

Δ+ W = (n*f) tan (*a*) + D tan (*b*), for paraxial light, *b*=n**a*, and tan (*a*) approximately equals to *a* in radians and tan (*b*) approximately equals to *b* in radians. This means n*tan (*a*) = n**a* =*b*= tan (*b*), for angle *a, b* being small. This means the following:

D" = D + n*f = Δ/tan(*a*) + W/tan(*b*) = (Δ+W/n)/tan(*a*) or D" tan(*a*)= (Δ+W/n),

This means Δ < D" *tan (*a*)<D' *tan(*a*), or 1/Δ> 1/(D"* tan (a))> 1/(D'*tan(a)), with the conversion factor between millimeter to inch (i.e. 25.4 millimeter per inch), **1/Δ> 25.4/(D"* tan (*a*)) (dpi).** Similarly Δ < D'* tan (*a*), (i.e. distance measured from display panel to the most distant point in the visible range), and **1/Δ> 25.4/(D'* tan (*a*)) (dpi).**

This means **1/Δ> 25.4/(DIS* tan (*a*)) (dpi).** By setting the distance in the normal direction of the observer to the display panel to be **DIS, wherein DIS is between D' and D" or be at the most distant point D'.** The **definition** of the pixel section (1/Δ) therefore is defined with respect to the angular

separation of the image light from the adjacent pixel section. This reference however does not teach explicitly that the equation for definition is of the form recited in the claims. But the claims also fail to give meaning for the claimed equation such feature can only be examined in the broadest interpretation. It is known in the art that normal or general eyesight for a human being is 1.0, which means the minimum angular separation, is 1/60 degree or one minute. This leads to if the angular separation angle *a* is set to be at least 1/60 degrees or one minute, i.e. the minimal angular separation, it gives a minimum value for the definition. This means the **definition** is **1/Δ> =25.4/(D"* tan (1')) (dpi), where the angle "a" is 1 minute.**

Claims 1 and 14 recite the phrase that "*a number of pixels sections per inch in the horizontal direction is configured such that a resolution of the image in the horizontal direction as projected in the three-dimensional visible range is no less than the resolution by the eyesight of a viewer whose midpoint between the right eye and the left eye is positioned in the three-dimensional visible rang*". This feature is **implicitly** met since the three-dimensional image is observed by the observer when the observer placing his eyes within the three-dimensional visible range, (i.e. the left eye image and right eye image are resolved and projected to the left eye and right eye respectively). The pixel definition (i.e. pixel per inch), has to be greater than resolution of the eyesight in order for the image to be able to be viewed. Furthermore, as explicitly stated about the definition of the display has expression **1/*L* >= 25.4/(D'* tan (1'))(dpi).** This means the number of the pixels per inch is no less than the resolution of the eyesight.

This reference has met all the limitations of the claims with the exception that it does not teach explicitly that the pixels of the display device emit the image light. It is known in the art that the geometric relationship between the definition in term of the viewing distance of the observer does not change by whether the fact that the image pixels actually emit the light themselves or the image light reflected from them since the definition is defined by the geometric relationship set forth in above, (the applicant is noted no where in the mathematical deduction above does the fact of the origin of the image

light come in to become a determining factor). Furthermore, it is well known in the art to use display device such as liquid crystal display device to provide the display panel having plurality of pixels sections and optical unit that emits the image light emitted from the liquid crystal display device to provide the stereoscopic image display as demonstrated by **Ichinose** et al. **Ichinose** et al teaches explicitly about same geometric relationship between the image definition and the observation viewing distance, (please see Figures 8-9). It would then have been obvious to one skilled in the art to apply the teachings of Ichinose et al to use liquid crystal display device as the display panel for the benefit of allowing the stereoscopic image display arrangement of **Momochi** be applied to a variety of display device utilizing liquid crystal display device such as television, video game device or computer.

With regard to claim 3, Ichinose et al teaches explicitly that the display device having this display panel could be a liquid crystal display device, (please see column 2, line 5 or column 5, lines 38-40).

With regard to claim 11, Momochi teaches the image display device is intended for displaying three-dimensional images taken from photographs and being processed by a computer, (please see 3). However it does not specify that it is movie picture. But the application of such display apparatus to display movie pictures would have been obvious to one skilled in the art since it involves only feed in movie pictures to the computer for processing, and such modification has the advantage of displaying three dimensional movie pictures.

With regard to claims 12-13, this reference also does not teach explicitly that the display apparatus is applied to different portable devices. However it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex parte Madham, 2 USPQ2d 1647 (1987).

With regard to newly added claim 30, Momochi et al teaches these equations or relationships explicitly. As illustrated in Figure 6, the *angular separation* between the image lights from the two

adjacent pixel sections is α and the angular separation of the image light after passing through the optical unit or lenticular lens is β. Then the following condition can be established:

$\Delta/nf = \Delta/H = \tan(\alpha)$, this means $\Delta = H * \tan(\alpha)$,

$W/D = \tan(\beta)$, this means W (or e) $= D * \tan(\beta)$,

$n * \sin(\alpha) = \sin(\beta)$.

"2Δ" being the pitch of a pixel section, "W" being the separation distance between two eyes, (i.e. the same as "e"), nf being the distance between the lenticular and the pixel section (i.e. same as H), and D is the distance between the lenticular lens and the eyes, (i.e. same as D-H, in the claim). It is noted that the Snell's law satisfies, $n*\sin(\alpha) = \sin(\beta)$, with n being refractive index of the lenticular lens.

5. **Claims 2, 4, 7, 15, 26, 28 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Momochi and Ichinose et al as applied to claims 1 and 14 above, and further in view of the patent issued to Isono et al (PN. 5,315,377).**

The method and apparatus for outputting image for stereoscopic vision taught by **Momochi in view of the teachings of Ichinose et al** as described for claims 1 and 14, above have met all the limitations of the claims. With regard to claims 2 and 15, this reference does not teach explicitly about the definition of the pixel section in a second direction of the pixels matrix. With regard to claim 4, this reference also does not teach explicitly that the optical unit can be a parallax barrier with a plurality of slits. **Isono** et al in the same field of endeavor teach a three-dimensional image display wherein a *parallax barrier* having a plurality of slits (Figures 2, 4 and 8A), that is aligned with the matrix arrangement of the pixels (Figures 8B and 9) is used to provide the three-dimensional image display. It is implicitly true for square or rectangular type of pixel section, ***the same definition analysis*** disclosed above also applies for the vertical direction of the matrix to allow the image being resolved by the eyes of the observer to achieve stereoscopic viewing. It would then have been obvious to one skilled in the art to

apply the teachings of Isono et al to modify the display apparatus of Momochi to use parallax barrier, an electronic one as disclosed by Isono et al, as alternative means to achieve the stereoscopic image display for the benefit of allowing different design and control, (the electronic driven parallax barrier has the advantage of controlling the slit size), that suited for different application to achieve the stereoscopic image viewing.

Claim 2 recites the phrase that "*a number of pixels sections per inch in the horizontal direction is configured such that a resolution of the image in the horizontal direction as projected in the three-dimensional visible range is no less than the resolution by the eyesight of a viewer whose midpoint between the right eye and the left eye is positioned in the three-dimensional visible rang".* This feature is **implicitly** met since the three-dimensional image is observed by the observer when the observer placing his eyes within the three-dimensional visible range, (i.e. the left eye image and right eye image are resolved and projected to the left eye and right eye respectively). The pixel definition (i.e. pixel per inch), has to be greater than resolution of the eyesight in order for the image to be able to be viewed. Furthermore, as explicitly stated about the definition of the display has expression **1/*L* > =25.4/(D'* tan (1')(dpi).** This means the number of the pixels per inch is no less than the resolution of the eyesight.

With regard to newly added claim 31, Momochi et al teaches these equations or relationships explicitly. As illustrated in **Figure 6**, the *angular separation* between the image lights from the two adjacent pixel sections is α and the angular separation of the image light after passing through the optical unit or lenticular lens is β. Then the following condition can be established based on the geometry and trigonometry theorem:

Δ/nf = Δ/H= tan (α), this means Δ = H* tan (α),

W/D= tan (β), this means W (or e) = D* tan (β),

n *sin(α) = sin (β).

"2Δ" being the pitch of a pixel section, "W" being the separation distance between two eyes, (i.e. the same as "e"), nf being the distance between the lenticular and the pixel section (i.e. same as H), and D is the distance between the lenticular lens and the eyes, (i.e. same as D-H, in the claim). It is noted that the Snell's law satisfies, $n*\sin(\alpha) = \sin(\beta)$, with n being refractive index of the lenticular lens.

6. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Momochi and Ichinose et al as applied to claim 1 above, and further in view of the patent issued to Chikazawa (PN. 5,852,512).

The method and apparatus for outputting image for stereoscopic vision taught by **Momochi in view of the teachings of Ichinose et al** as described for claim 1 above have met all the limitations of the claims. Momochi teaches the optical unit is a *lenticular* lens having a plurality of cylindrical lenses. However it does not teach explicitly that the cylindrical lenses are arranged periodically in the horizontal direction and extended in the vertical direction. But it is true that the lenticular lens of Momochi is arranged periodically in the horizontal direction. And it is implicitly true that the lenticular lens is extended in a perpendicular direction with respect to the periodical direction as explicitly demonstrated by the teachings of **Chikazawa**. **Chikazawa** in the same field of endeavor teaches a lenticular lens having a plurality of cylindrical lenses that are arranged along the horizontal direction of the pixels and extended in the vertical direction. It would have been obvious to one skilled in the art to make the lenticular lens has this geometric arrangement for the benefit of providing horizontal parallax to allow stereoscopic vision.

(10) Response to Argument

I. Clams 25-31 Are Adequately Supported, Described, And Enabled As Required by 35 USC 112, First Paragraph.

The examiner has withdrawn the rejection and therefore no further response to the arguments is provided.

II. Claims 25-31 Are Definite As Required by 35 USC 112, Second Paragraph.

The examiner has withdrawn the rejection and therefore no further response to the arguments is provided.

III. Claims 1, 3, 11-13, 14, 15, 27 and 30 are patentable under 35 USC 103(a) over an alleged obvious modification of Ichinose (US 4, 987,487)

In response to appellant's arguments which state that the Examiner has failed to establish prima facie obviousness, the examiner respectfully disagrees for the reasons stated below.

Firstly, the appellant argues that the cited Ichinose does not disclose any particular pitch with respect to minimal angular separation (1/60 degrees or one minute) which is discernable by a viewer, rather Ichinose intends to permit stereoscopic vision by a viewer moving side to side or away from the display apparatus, the examiner respectfully disagrees. Since in order for the stereoscopic vision to be observable by a human viewer, the image pixel pitch ***has to be greater than*** the minimal resolution discernable by the human eyes in order for any image, not only stereoscopic image, to be discerned and viewed. The normal eyesight, 1.0, for a human being, due to the structure of the eyeball, is defined as a human eye can resolve and distinguish two objects from each other at a standard distance, when the two objects are separated angularly by 1/60 degrees or one minute arc, (this is known as the ***minimal angular separation).*** So even if the part of the disclosure of cited Ichinose reference is referred to accommodate the movement of the observer side to side, in order for the stereoscopic image or any image to be viewed at all, the pitch of the pixels of the display panel *has to be greater* than the minimal angular separation that a human eye is capable to discern. The appellant argues that Ichinose does not teach to change the pixel pitch as the viewer moves closer or further from the display, this argument is not persuasive and is

irrelevant since the Ichinose reference does not teach that the viewer is moved away or closer to the display panel, (i.e. the normal distance between the viewer and the display panel is not changed). And since the instant application does not teach such either and since the pitch or number of pixel per inch defines a definite viewing zones for the observer, movement *within* the viewing zone will not make the image beyond the resolution limit of the human eye. The knowledge of normal human eyesight being 1.0 or the minimal angular separation being 1/60 degrees or 1 minute arc is the limitation of the human eye structure and is well known in the art. To use such limit to design the pitch or number of pixels per inch of the display so that observer's eyes can *resolve* the images and to properly view and perceive them is considered fundamental knowledge and motivation for modification to one skilled in the art to design the apparatus for the benefit of letting the image displayed on the display panel being properly resolved, viewed and perceived.

In response to "**Failure to Establish Prima Facie Obviousness" (page 15 of Brief)**

In response to appellant's argument which states that Examiner's logical rationale is unsupported, the examiner respectfully disagrees. Appellant arguments which state that "the television/display monitor come in multitude of display resolution with the difference between resolution being discernable by the human eye i.e. high definition versus standard television viewing" so the rationale for the resolution must be greater than that discernable by the human eye, is not supported, the examiner respectfully disagrees for the reasons stated below. **Firstly**, the instant application and the claims are all drawn to the *minimum* limitation of *resolution of the eyesight of a viewer* not any other "multitude of display resolution", (please see the claims, wherein angular separation of 1 minute is also referred to *human* resolution). The minimum resolution limitation of the human eye decides if two objects can be resolved by the human eyes, it does not concern if the human eyes can view both higher or lower resolution display device, as long as the resolutions are *greater* than the minimum value. The

specification and the claims also fail to disclose what is this "multitude of display resolution" and therefore it is not clear what is the appellant refers to. **Secondly**, the instant application also uses the minimum angular separation of human eyes to determine the definition or "number of pitches per inch" of a display panel, so it is the "resolution of the human eyesight", not the so-called "multitude of display resolution", is relevant here. **Thirdly**, in order for the viewer to clearly resolve and view the image, the image resolution has to be *greater* than the human eyesight resolution allowed since after all it is the viewer's eye that is the final receptor for the image to be viewed. It is therefore supported and rational to request the image pitch to be greater than the minimal angular separation for a normal human eyesight.

Appellant's arguments recited in page 16 of the brief, concerning "the Examiner insists that raising the definition of an image display apparatus so that it is greater than the *resolution* by eyesight would have been obvious to one skilled in the art", are confusing and not relevant. The arguments present in the paragraph seem to be general comments concerning the importance of the definition of the image display device and are not arguments to Examiner's reasons for rejection. However the examiner wishes to further explain why it is obvious to one skilled in the art to have such arrangement. By definition, the **image resolution** is " ***referred to how close image lines can be to each other and still be visibly resolved".*** So **higher** the ***resolution*** means the image display has ***smaller*** not ***greater the pixel pitch.*** According to this definition, raising the definition of the display device the *resolution* of the image display device or the *image pitch* has to be made *smaller*. But the image pitch cannot be unlimited small rather it has to *be not less than* the resolution (minimum image line separation) of the eyesight of a human being, in order to be perceived by a human viewer. This condition is posed by the structure of human eye. This explicitly reads on the claim limitations. In response to appellant's arguments concerning the relied Reference 1 (Vision Vol. 17, No. 2, pp. 113-122, 2005), in particular concerning the statement of "a stereoscopic image is concerned, it is doubtful whether an improvement in image quality

... increases inconsistency between the accommodation and "vergence" to easily cause fatigue", the examiner respectfully states that such statement does not oppose to and has nothing to do with the idea that the number of pixels per inches or the definition of the display panel has to be greater than the minimum angular separation or the normal eyesight allow, since such limitation is the essential requirement for the image to be resolved and properly perceived by the a human viewer. The question is not about to have *higher* definition but to have a *definition* greater than a minimum limit posed by the structure of the human eye that allows the human eyes resolve the image and such requirement is desired and essential for image display and viewing.

Based on the arguments stated above, modification of the display Ichinose to produce an image having no less resolution than the eyesight of a viewer is not only obvious but also essential in order for the image displayed by the display panel can be properly resolved by the human eyes of the observer. The question concerning the modification is not so much of getting higher definition only but to find the minimum limitation of the definition or number pixels per inch that the display panel may allow for the human eye to properly resolve and view. The modification therefore is not only obvious but also essential.

In response to appellant's arguments recited on pages 17-18, of the brief, which state that the cited Ichinose reference discloses a method for shifting pixel images to accommodate the movement of the viewer, and the appellant tends to suggest that this has nothing to do with the resolution of the image device and has nothing to do with making the resolution of the image device not less than the minimum angular separation of eyesight or resolution of the eyesight, however as argued above, if the resolution (or image line separation) is less than the resolution of the eyesight, no image can be resolved by the eye and no meaningful image can be viewed. The modification or even the condition therefore has to be implicitly included in the stereoscopic image display apparatus of Ichinose reference in order for the apparatus to be properly operated. In response to appellant's arguments that the Examiner fails to

articulate a valid reasons as to why one of the ordinary skill in the art would modify the pixel pitch in view of the minimum angular separation of the eyesight of a human, the Examiner respectfully states that the reasons or motivation is for the image displayed can be resolved by a human viewer so that a meaningful image can be perceived. The normal eyesight or eyesight 1.0 referred to the minimum angular separation of 1/60 degrees or 1 minute arc is common knowledge in the art. The appellant must understand the pixel pitch to provide the minimum *angular* separation of the eyesight of a human is adjusted by the distance between the eye and the display device. This is why for display panel with a definite definition or a definite number of pixels per inch, there is only a range of viewing distances from the display panel that the viewer can be positioned to properly view the image displayed.

In response to appellant's arguments which state that the cited Ichinose reference fails to explicitly state the cited equation, which therefore differs from the instant application, the Examiner respectfully disagrees and refers appellant's attention to the reasons for rejection stated above for the **explicit derivation** of the cited equation from the geometric setup of the display apparatus of Ichinose. In response to appellant's argument which states that the Examiner has derived the similar equation based on the disclosure of the instant application, or in hindsight manner, the Examiner respectfully disagrees and respectfully request the appellant to demonstrate and prove that **why** any other person in the art would not be able to arrive the equation independently without the disclosure of the specification. In fact the explicitly derivations of the equations stated in the reasons of rejection is not at all present in the specification of the instant application. Also if the appellant believes the Examiner reaches the same equation by the disclosure of the specification of the instant application, then why the appellant would raise so much questions and objections concerning the derivation stated in the reasons for rejection? While the appellant attacks that the derivation of the equation by the Examiner fails to provide rationale basis, they should have *at least the same rationale basis* as the instant application since if as accused by

the appellant the derivation is based on appellant's *reasoning*. Furthermore, the Examiner fails to see that the specification of the instant application provides any rationale basis for the derivation. So by the same line of arguments, the equation recited and claimed by the appellant should not be regarded as proper and correct, if appellant's arguments and accusations are correct. Furthermore, in response to appellant's argument which states that the Examiner fails to provide valid rationale to plug in value, (value of angle "a" being 1/60 degrees or one minute), into the equation 1/L>= 25.4/(DIS*tan(a)) (dpi) to arrive at X>=25.4/(D*0.000291), the examiner respectfully disagrees since the angle "a" being 1/60 or one minute is referred to the minimal angular resolution of human eye and the rationale is for the number of pixels per inch to be greater than the resolution limited by the minimal angular separation so that the image pixels displayed can be properly resolved and meaningful image not blur image can be perceived. The angular value 1/60 degrees or one minute gives a minimum limit for the line separation of the pixels allowed to give meaningful and perceivable image to the observer.

In response to appellant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971). The appellant has argued that making the modification based on the contention that a minimum angular separation of a human eyesight is 1.0 or one minute is hindsight reasoning, the Examiner respectfully disagrees since the minimum angular separation of human eyesight being 1.0 or one minute is the result of human eye structure that is common knowledge to one skilled in the art. (Noted, 0.000291 recited in the equation is the value of tangent of 1 minute). The essential requirement and the motivation for combining the minimum angular separation or normal eyesight 1.0 condition into the minimum requirement for the pixel size, is to allow

the image pixels be properly resolved by human eyes so that meaningful image not blurring image be viewed. The blurring of the image will certainly introduce fatigue to the viewer.

In response to appellant's arguments, page 20 of the brief, concerning the "apparent errors" within the derivation of equation provided by the Examiner based on the disclosure of the Ichinose reference, the Examiner respectfully disagrees for the reasons stated below.

(1). In response to appellant's arguments which state that based on Figure 8 of Ichinose reference the smallest separation between *two adjacent* image pixels section should be 2L not L accordingly the definition should 1/2L not 1/L, the examiner respectfully disagrees. The image separation between the *right*-eye image and *left*-eye image (the left portion and right portion of the image pixel sections) is L not 2L and the eyes need to resolve the right eye image from the left eye image. It is noted that each of the left eye image and right eye image has a size of "L", the separation distance between the *adjacent* two therefore has to be "L" not "2L". The separation distance between the two adjacent left and right eye pixels is "L", and the separation distance between the adjacent PAIR of the left and right eye images are at least "2L", since while the individual pixel has size "L" and PAIR of the pixels has size "2L". The definition therefore must be 1/L, not 1/2L.

(2). In response to appellant's question concerning the rationale of "L+e= (f*tan(a)) +(D*tan(b))", the appellant being one skilled in the art must understand that the equation relates the resolution with the angular separation of the eye. This is the rationale basis for the equation. Furthermore, the equation is derived based on actual distance between the midpoint of the eyes and the display panel. Also in response to appellant's question that tan(a) should be approximately equal to angle "a" not tan(b) and then angle "b", the appellant being one skilled in the art must have the basic knowledge in trigonometry that angle "a" equals to angle "b" for they are two opposing angles of two straight lines as shown in Figure 8, (line crossing at the center of the lens element). It is not clear how does the appellant obtain angle "a" equals 65mm, (please see page 21 of the brief), since "a" is an angle not a length, the

arguments are wrong and cannot be addressed. With regard to appellant argument that for distance D being 400 mm, the angle is about 9 degrees, not 1/60 degrees, which therefore means the Examiners' result is unsupportable, the examiner respectfully disagrees. The example distance 500 mm or 400 mm, demonstrated by Ichinose shows exactly that the number of pixels per inch has to be *greater* than the minimum limit set by the minimal angular separation at 1/60 degree. The Examiner's result is positively supported by the *actual* design value. Note the equation only poses a *minimum* limit, so any value greater than the minimum limit satisfies the equation.

(3). In response to appellant's argument concerning the "parallax barrier" being included in the derivation, the assumption is being made to simplify the derivation without consider the effect of refractive index of the parallax barrier and any one skilled in the art understand that the lenticular lens and parallax barrier function identically, such that the image lights from the pixels *focus* and cross through the centre of the lens element, (as shown in Figure 8 of Ichinose), the same way as they cross through the center of the slit of the parallax barrier. The center of the lens serves as the slit of the parallax barrier. The image lights then pass and cross through the center of the lens or the slit of the parallax barrier to reach the eyes of the observer. The lenticular lens and the parallax barrier therefore can be interchangeably applied in the derivation or the derivation is true and the same for both the lenticular lens and parallax barrier as the optical unit. .

(4). One skilled in the art must understand for small angle, tan(a) approximately equals to angle "a", tan(a) and angle "a" therefore can interchangeably used for small angle "a" but tan(a) is more exact than angle "a" assumption.

(5). Please see section (1) for the explanation as why the definition is 1/L.

(6). It is not clear where does the appellant obtain that the angle "a" must be of 9 degrees. Appellant's argument based on such value is not proper. If this 9 degrees is obtained by the example design values for the stereoscopic display, this value then positively supports the Examiner's derivation to

show that angular separation angle has to be greater than 1/60 degree and the number pixels per inch has to be greater than the minimum value set by the minimal angular separation. Also the angle can be adjusted and then modifies the definition of the display, so even if the value is derived from possible design specifics of the device it does not mean the value is wrong or the derivation is wrong. The reasons for modifying the equation to *allow angle "a" taking 1/60 degree or 1 minute* is to use the *minimum* value of the angle "a" that a human eye can allow to angularly separation two objects from each other so that a minimum value for the definition of the display can be defined. Such minimum value is essential for one skilled in the art to design the display to allow proper image be viewed. This minimum angle of separation for a human eye is based on the nature and structure of human eye and it is well known in the art. The Figures demonstration depicted in (b) of page 22 of the appeal brief is incorrect since both Ichinose and instant application teaches that the image light from the pixels has to pass an optical unit such as lenticular lens or parallax barrier, the optical unit will make the image light *focus* and *cross* at the center of the optical unit. The corrected depiction of the image light should be as shown in Figure (a).

(7). The arguments provided are not respect to the cited Ichinose (PN. 4,987,487) they are not proper arguments concerning the rejection based on Ichinose (PN. 4,987,487) reference.

In response to appellant's argument which states that the Δ, (referred to cited Momochi reference) is referred to pitch of a pixel not a pitch of the pixel section, the examiner respectfully disagrees. It is noted that the "pixel section" indicated by "q" in Figure 7 of Momochi is referred to pixel sections includes **both** right eye and left eye image pixel sections, and this means the pixel pitch Δ is the pixel pitch for the right eye pixel section and for the left eye pixel section, respectively. The separation between the right eye pixel section and the left eye pixel section is Δ, not 3Δ.

With the arguments present above, it shows there is no error concerning derivation of the equation by the Examiner based on the simple geometric set up of the display apparatus of Ichinose. The limitations concerning having the resolution or the image line separation being greater than the resolution

of the eyesight of a viewer or the equation N >= 24.5/(D* tan(1')) is met by the modification to the disclosure of Ichinose (PN. 4,987,487) for the reasons to allow the image being properly resolved and viewed by a human viewer. **The Examiner has established the prima facie case of obviousness for the rejection of claims based on Ichinose (PN. 4,987,487) reference.**

In response to section "Even If Combined As Suggested Not All Claim Features Disclosed"

In response to appellant's arguments which state that the cited Ichinose reference fails to suggest "wherein the pixel sections are arrayed such that a number of pixel section per inch in the horizontal direction is configured such that a resolution of the image in the horizontal direction as projected in the three-dimensional visible range is no less than the resolution of the eyesight of a viewer whose midpoint between the right eye and the left eye is positioned in said three-dimensional visible range" (please see brief page 23), the Examiner respectfully state that this limitations are met and has to be met by the disclosure of Ichinose reference for the reasons stated in the "reasons for rejection", for the reasons stated above and for the simple reasons that the observer **is** able to view and resolve the right eye and left eye images, as disclosed in the cited Ichinose reference. For short, this limitation has to be met by the disclosure for the resolution or the image line separation cannot be less than the minimum image line separation corresponding to the eyesight of a human eye in order for the eye to resolve the image and to perceive meaningful image. Furthermore, the appellant seems to confuse with the change of pixels in accommodation with the movement of the viewer **with** the **fundamental requirement** for the image line separation to be at least the minimum possible separation (minimum angular separation or resolution of eyesight) in order for the human viewer to even perceive the image without blurring. The issue concerning the movement of the viewer does not interfere with the issue concerning the image being resolvable by a human eye.

In response to appellant's repeated arguments that the resolution of the eyesight of a viewer is not

contemplated or mentioned in cited Ichinose reference, the examiner respectfully disagrees for such essential feature has to be implicitly included for otherwise no meaningful image without blurring can be viewed in the stereoscopic display apparatus of Ichinose. To have the number pixel per inch that provides a *resolution* projected in the three-dimensional visible range no less than the resolution of eyesight of viewer whose midpoint between the right eye and left eye positioned in the three dimensional visible range is the *essential* requirement for the observer to resolve the image, to allow the left eye image viewed by the left eye and the right image viewed by the right eye, respectively (as shown in Figure 8 as Ichinose, for three-dimensional viewing condition) and to view them properly without blurring.

In response to appellant's arguments which state that the cited Ichinose reference does not disclose related to the resolution of a viewer and the definition of a three-dimensional image, (please see page 24 of the brief), the examiner respectfully disagrees for the reasons stated above and for the reasons that the instant application also does not disclose the "definition of a three dimensional image". It is noted that all the images are really two dimensional in nature there is no image by itself being "three dimensional". So it is not clear what does the appellant mean by "definition of the three dimensional image". Ichinose teaches that by having the number of pixels per inch greater than the minimum value set by the minimal angular separation (1/60 degrees), the projected images at the three dimensional viewing angle would be resolved by the viewer since it is within the human eye resolution range.

For the arguments present above, it is believed the disclosure of Ichinose and the general knowledge of nature of human eyesight read on claims 1, 3, 11-13, 14, 25, 27 and 30. The rejection therefore still holds and is proper.

IV. Claim rejection (Brief pages 25-30)

Appellant fails to provide further arguments with regard to the rejections based on Ichinose in view of Isono et al reference.

In response to appellant's arguments based on the newly provided Reference 1 (Vision Vol. 17, No. 2, pp. 113-122, 2005) which provides objective evidence that is it **not always** when perceiving a three-dimensional image an image having higher resolution is preferable for visual perception, where appellant implies that having higher image resolution is not **always** a motivation for modification, however the Examiner takes the statement means that modification to achieve higher resolution **is a** reasonable motivation to one skilled in the art to modify the display device, even if it is not **always the case**. Furthermore, if higher definition or resolution for obtaining clear picture is not a motivation for improving image display, then why high definition display device is so popular now. Appellant's arguments do not prove that the modification of Ichinose stereoscopic image display apparatus to achieve higher definition is not a relevant motivation to one skilled in the art for the benefit of displaying and perceiving clear image. Furthermore, the motivation for modification is not just achieve higher resolution but to *ensure* the resolution of the pixel section is *greater* than the *minimum limitation* that human eye allows so that meaningful image can be viewed. The arguments based on the Reference 1 therefore are not persuasive to overcome the rejection. The comments concerning the binocular fusing is properly satisfied by the disclosure of Ichinose stereoscopic display apparatus, for as explicitly demonstrated in Figure 8, the right eye image with feature points and the left eye image with feature points are properly directed to right eye and left eye respectively. No fatigue of the eyes would result if the right eye and left eye image are properly directed to the proper eye. This means the number of pixel per inch has to be greater than the definition or resolution limitation posed by the minimum angular separation of human eye. The comments concerning the "defocusing" is not relevant since the resolution limit of the human eye is different from the "defocusing" property.

The modification or the question is not so much concerned with getting higher definition rather it is more important to obtain the minimum limit of the number of pixels per inch that allow the meaningful image can be viewed by the human eyes without blurring.

For the reasons stated above, the rejections for claims 2, 4, 15, 26, 28 and 31 based on Ichinose in view of Isono et al (PN 5,315,377) still holds.

V. Claim rejection (Brief page 30)

Appellant fails to provide further arguments with regard to the rejections based on Ichinose in view of Chikazawa (PN. 5,852,512) reference.

The rejection of claim 5 based on Ichinose in view of Chikazawa therefore still holds.

VI. Claim rejection (Brief page 30)

Appellant fails to provide any arguments with regard to the rejections based on Momochi (PN. 5,528,420) in view of Ichinose reference.

For the reasons stated above, the rejection of claims 1, 3, 11-14, 16, 25, 27, and 30, (claim 29 has been canceled) based on Mooch reference in view of the Ichinose reference still hold.

VII. Claim rejection (Brief page 31)

Appellant fails to provide any arguments with regard to the rejections based on Momochi in view of Ichinose reference and further in view of Isono reference.

For the reasons stated above, the rejection of claims 2, 4, 7, 15, 26, 28 and 31 based on Momochi reference in view of the Ichinose and Isono references still hold.

VIII Claim rejection (Brief page 31)

Appellant fails to provide any arguments with regard to the rejections based on Momochi and Ichinose with regard to claim 1 and further in view of Chikazawa reference.

For the reasons stated above, the rejection of claim 5 based on Momochi reference in view

of the Ichinose and Chikazawa references still hold.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Primary Examiner

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